

THE WEATHER AND CIRCULATION OF JANUARY 1950<sup>1</sup>

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One of the most outstanding features of the general circulation of the Northern Hemisphere during January 1950 at the 700-mb. level (and throughout the troposphere) was the strong ridge which extended in a northwest direction from a center of high pressure about halfway between Hawaii and Lower California to the Arctic Ocean (see fig. 1). The maximum positive anomaly of 700-mb. height associated with this ridge, 900 feet in the Alaskan peninsula and southeastern Bering Sea, is by far the greatest anomaly ever observed in this region on any monthly mean map during our 18-year period of record (1932-50), and has been exceeded only once at any place

in the entire Northern Hemisphere.<sup>2</sup> At sea level the maximum positive anomaly in this region was 25 millibars, a value which has been exceeded only once (January 1909) during the past 50 years. Although a discussion of the evolution and cause of this tremendous ridge is beyond the scope of this article, its effects upon the general circulation were of the utmost importance for the weather of the United States. In general agreement with the principle of conservation of vorticity, it was accompanied by deep troughs and large areas of negative height anomaly at 700 mb. to both its east and west. Figure 1 shows that

<sup>2</sup> A positive 700-mb. height anomaly of 910 feet was observed on the west coast of Greenland during February 1947 (see article by Namias in MONTHLY WEATHER REVIEW, vol. 75, No. 8, August 1947, pp. 145-152).

<sup>1</sup> See charts I—XI following p. 21, for analyzed climatological data for month.

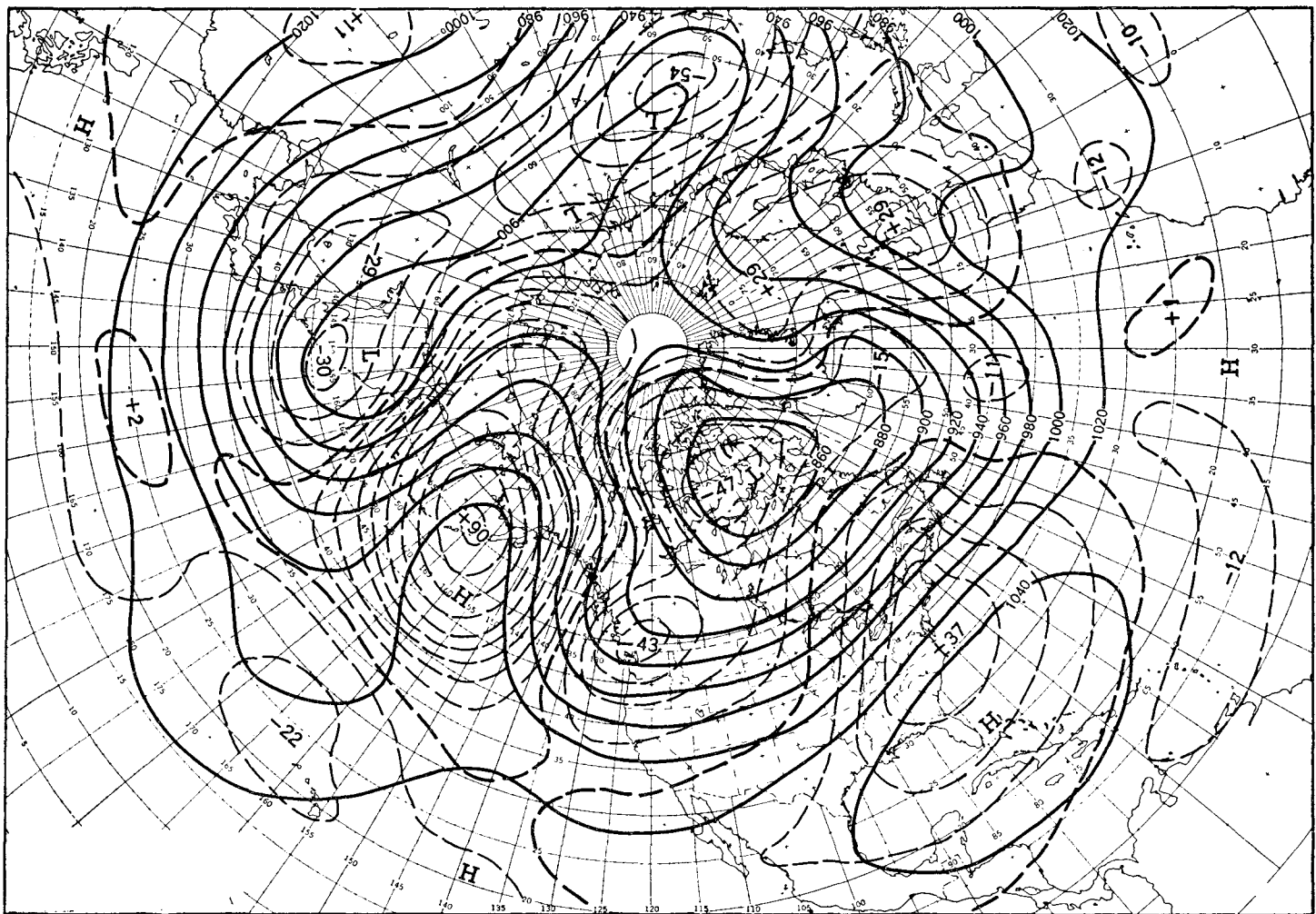


FIGURE 1.—Monthly mean 700-mb. chart for January 1950. Contours at 200-foot intervals are shown by solid lines, 700-mb. height departure from normal at 100-foot intervals by dashed lines with the zero isopleth heavier. Anomaly centers and contours are labeled in 10's of feet. (Chart covers 30-day period Dec. 31, 1949-Jan. 29, 1950 instead of calendar month.)

these circulation features were only a part of a larger system of four roughly sinusoidal waves in the middle latitude zonal westerlies encompassing the entire hemisphere.

This system of planetary waves, with a strong trough and below-normal heights in the West, and an intense ridge and above-normal heights in the East, represents a reversal of the normal January circulation pattern in the United States, which is characterized by a ridge in the West and a trough in the East. Comparison of charts I and V (see inserts following p. 21) with figure 1 shows that, as noted in previous studies of the dependence of weather upon the 700-mb. circulation, the area of subnormal surface temperatures had cyclonic curvature and negative height anomalies aloft, and the region of anticyclonic curvature and above-normal 700-mb. height was characterized by abnormal surface warmth. Similarly, most of the heavy precipitation was located in the region of strong southwesterly flow aloft near the point of inflection between the trough and the next ridge downstream. The departure from normal of the direction of mean air flow is assumed to be parallel to the dashed isopleths of equal 700-mb. height anomaly in figure 1 and is also related to surface temperature and precipitation. For example, surface temperatures higher than the normal were observed in areas of below-normal 700-mb. height in portions of Colorado and Idaho because of strong southwesterly flow relative to the normal. Likewise, stronger-than-normal westerly wind components produced heavy precipitation along most of the West Coast but created a rain-shadow east of the Rocky Mountains.

The tracks of centers of anticyclones and cyclones given in charts II and III are also helpful in explaining the observed surface weather. These tracks for the most part closely paralleled the 700-mb. mean contours observed during the month and were displaced south of their normal position in western United States and north of normal in eastern portions. Thus, cyclones from the Gulf of Alaska, which usually cross western North America

just north of the border of the United States, moved generally southeastward along the Alaskan coast through Oregon, Idaho, Wyoming, Nebraska, and Kansas. North of this track the foehn effects were greatly weakened, and intensely cold Arctic air and heavy snows predominated in the Dakotas, Montana, Washington, and Idaho. South of the cyclone track anticyclonic conditions, light precipitation, and milder Pacific air prevailed over most of the Southwest. Both at sea level and aloft the Bermuda High was abnormally dominant over eastern United States. It was instrumental in steering the principal storms northeastward from Kansas through Iowa and Wisconsin to Labrador and in preventing cold polar anticyclones from Alaska from penetrating the country appreciably except in the northern Plains. In fact, the Bermuda High was sufficiently strong to reduce precipitation to light along most of the Atlantic and Gulf Coasts.

The location of the principal 700-mb. troughs and ridges in the entire Northern Hemisphere during January 1950 was similar to that in January 1949.<sup>3</sup> Thus, during both months temperatures were abnormally cold in western Canada and northwestern United States and abnormally warm in eastern United States, the British Isles, and Mexico; while precipitation was generally heavy in the Hawaiian Islands and generally deficient in western Europe. Most of the centers of 700-mb. height anomaly in the western hemisphere, however, were farther north and more intense this January than last. Consequently, westerly wind components (relative to normal) produced wetter weather on the West Coast and much warmer, drier conditions in the Southwest during January 1950 than were experienced in January 1949, when easterly wind components prevailed. On the other hand, the greater intensity and northward displacement of the Bermuda High in January 1950 compared to January 1949 made this January the warmest on record in large portions of the eastern and southern United States.

<sup>3</sup> For detailed discussion of January 1949, see article by Klein in *Monthly Weather Review*, vol. 77, No. 4, April 1949, pp. 99-113.



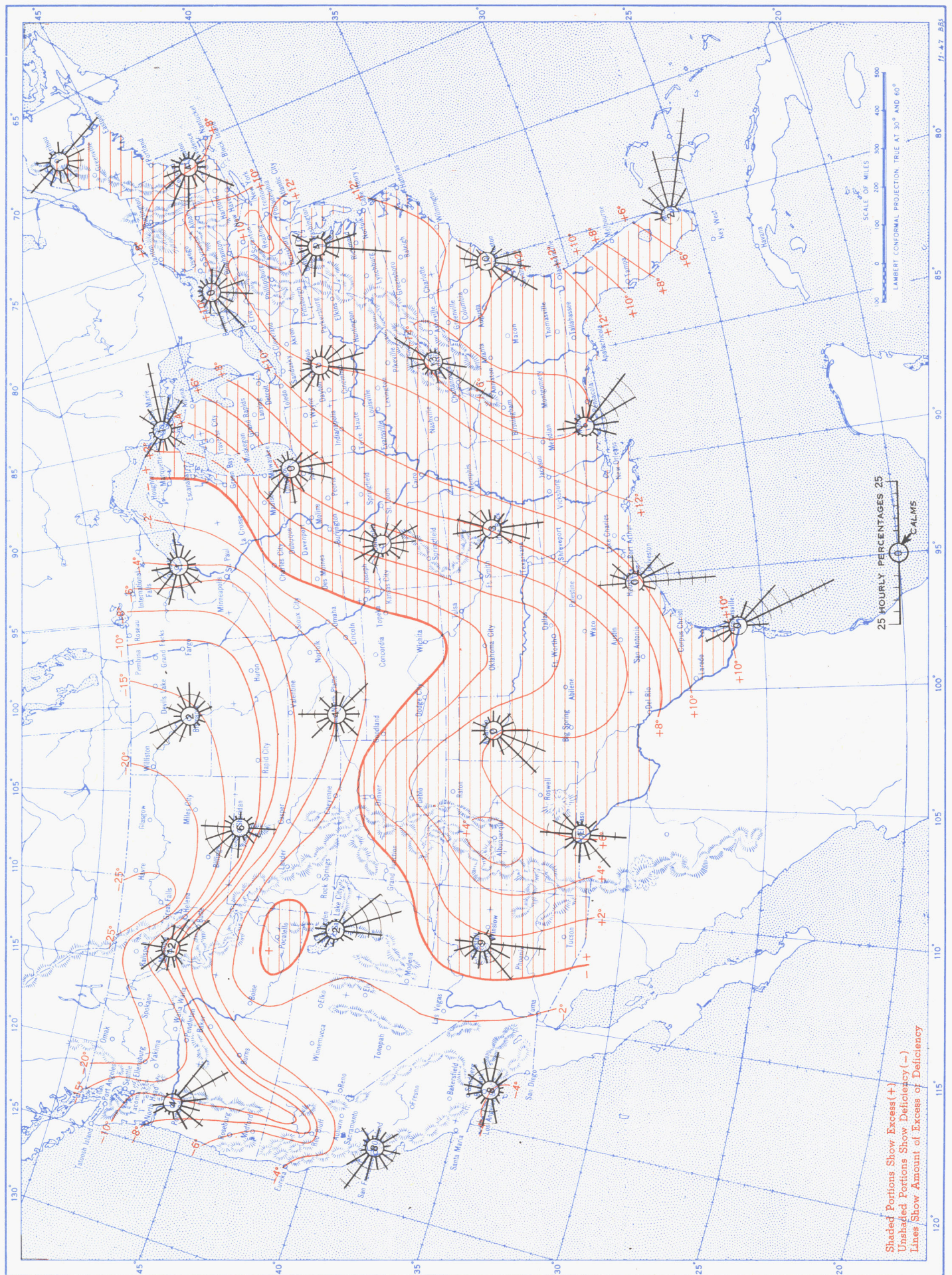
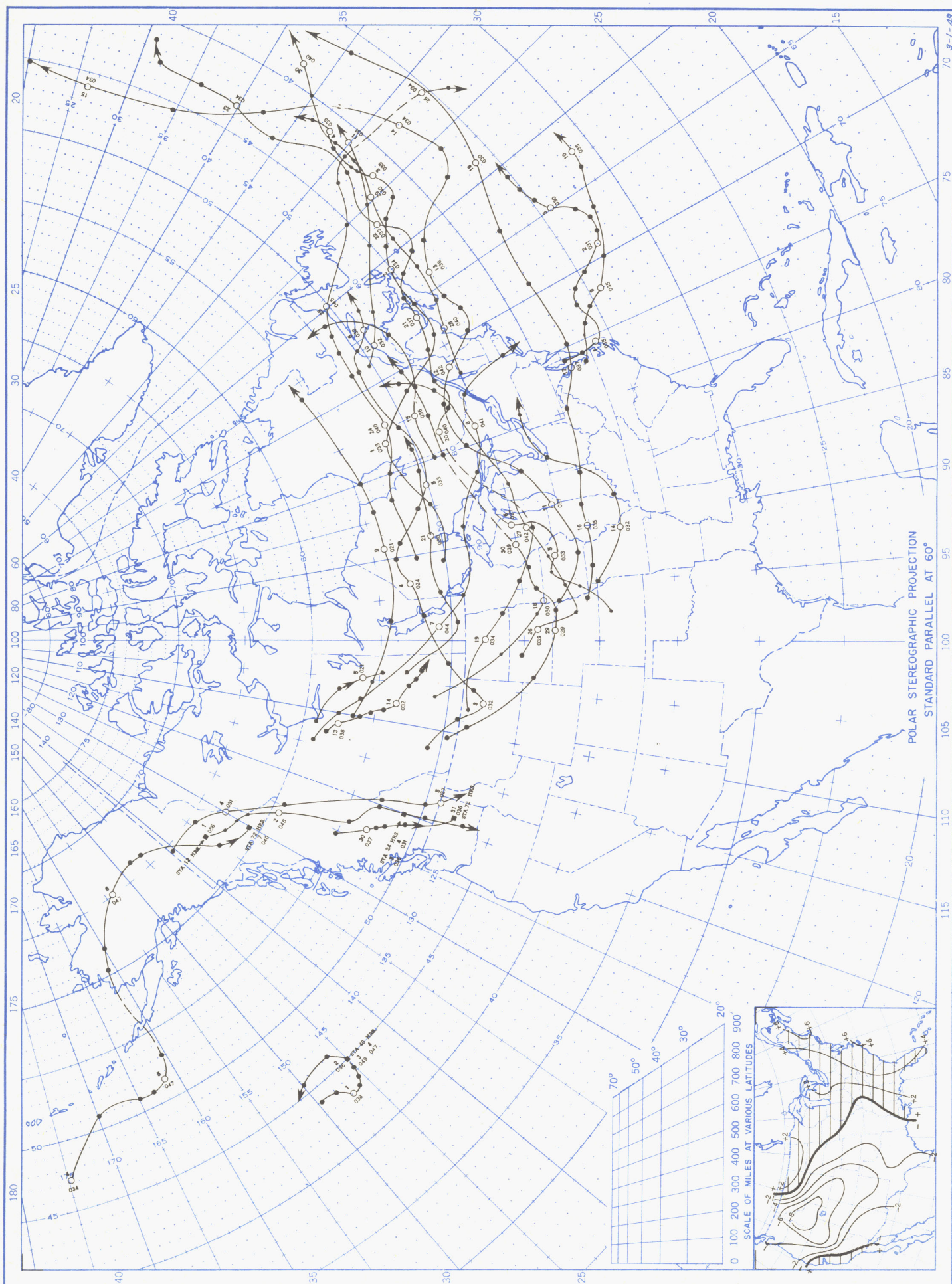
Chart I. Departure ( $^{\circ}\text{F.}$ ) of the Mean Temperature from the Normal, and Wind Roses for Selected Stations, January 1950



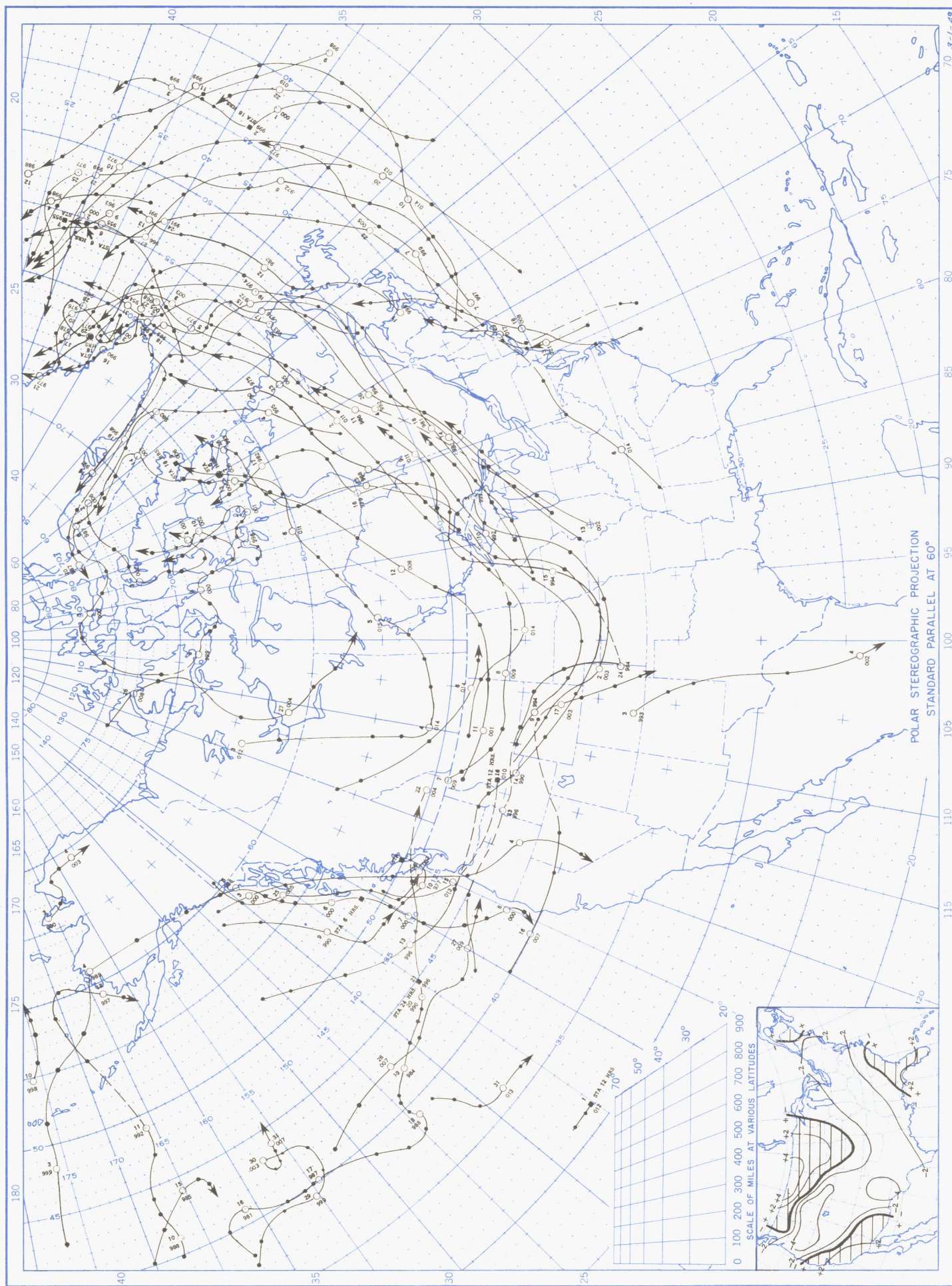
Chart II. Tracks of Centers of Anticyclones, January 1950. (Inset) Departure of Monthly Mean Pressure from Normal



Circle indicates position of anticyclone at 7:30 a. m. (75th meridian time). Dots indicate intervening 6-hourly positions. Figure above circle indicates date, and figure below, pressure to nearest millibar. Only those centers which could be identified for 24 hours or more are included.



Chart III. Tracks of Centers of Cyclones, January 1950. (Inset) Change in Mean Pressure from Preceding Month



Circle indicates position of cyclone at 7:30 a. m. (75th meridian time) Dots indicate intervening 6-hourly positions. Figure above circle indicates date, and figure below, pressure to nearest millibar. Only those centers which could be identified for 24 hours or more are included.



Chart IV. Percentage of Clear Sky Between Sunrise and Sunset, January 1950

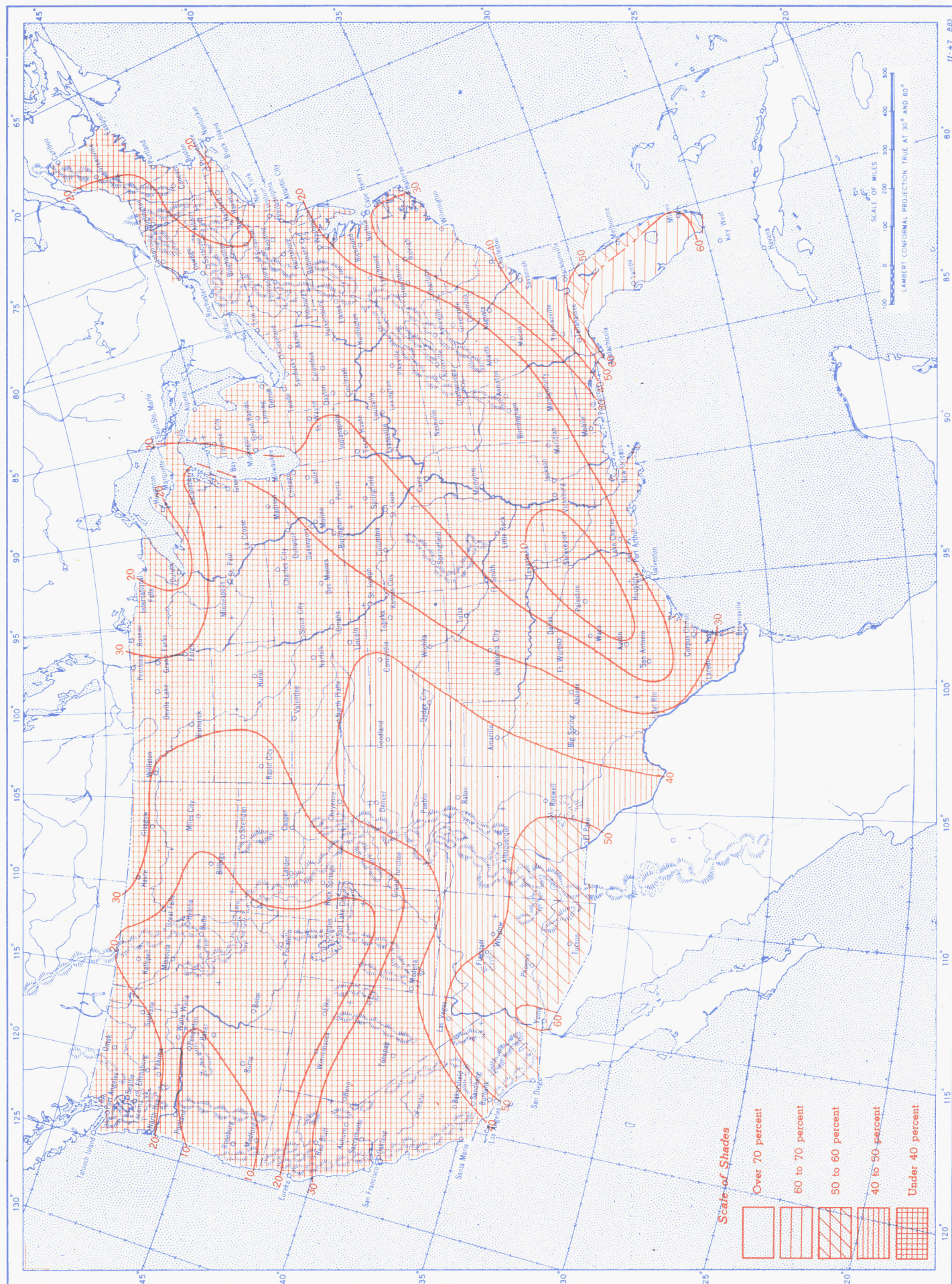




Chart V. Total Precipitation, Inches, January 1950.

(Inset) Departure of Precipitation from Normal

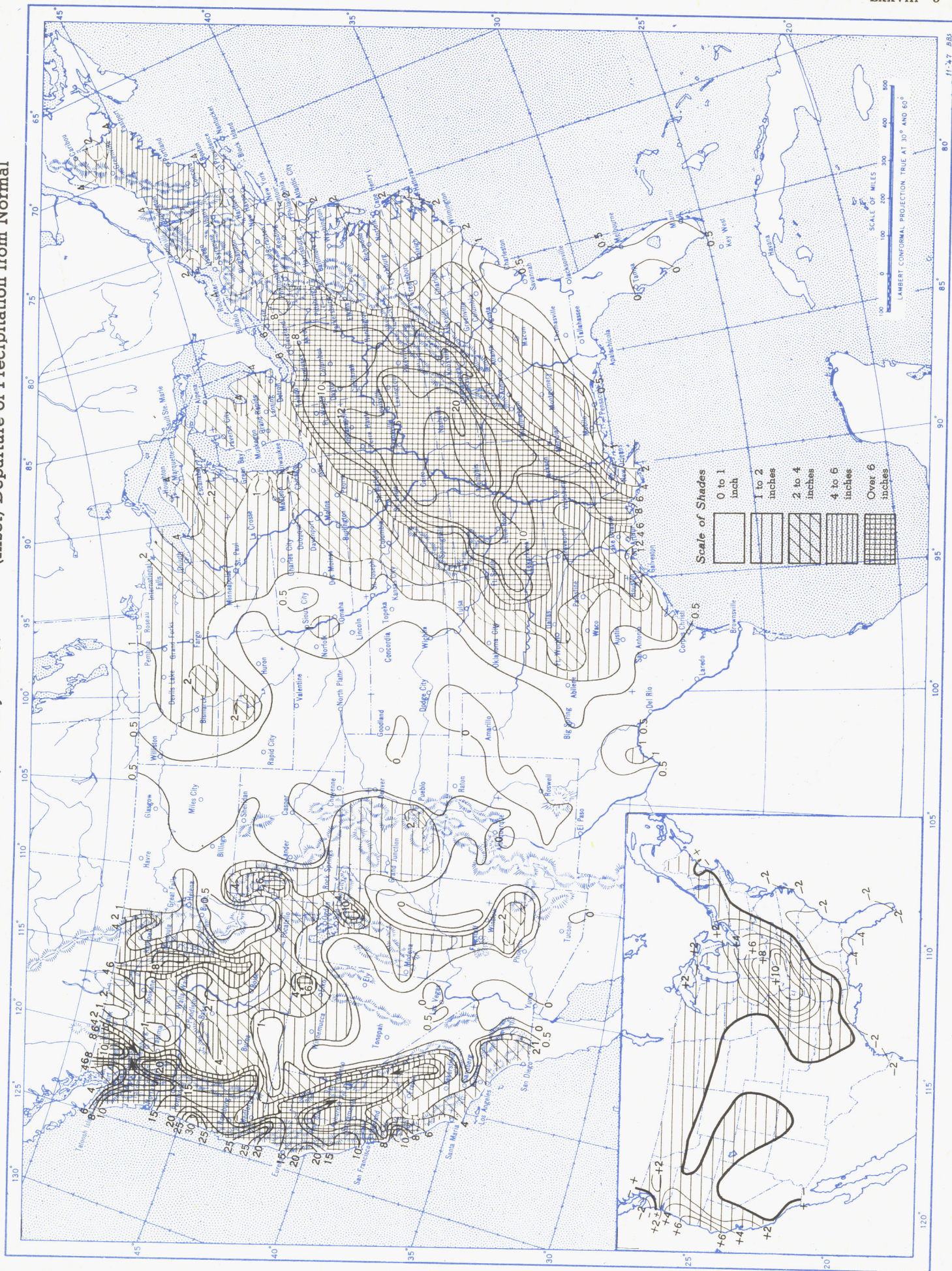




Chart VI. Mean Isobars (mb.) at Sea Level and Mean Isotherms (°F.) at Surface, January 1950









Contour lines and isotherms based on radiosonde observations at 0300 G. C. T. Winds indicated by black arrows based on pilot balloon observations at 2100 G. C. T.; those indicated by red arrows based on rawins taken at 0300 G. C. T.

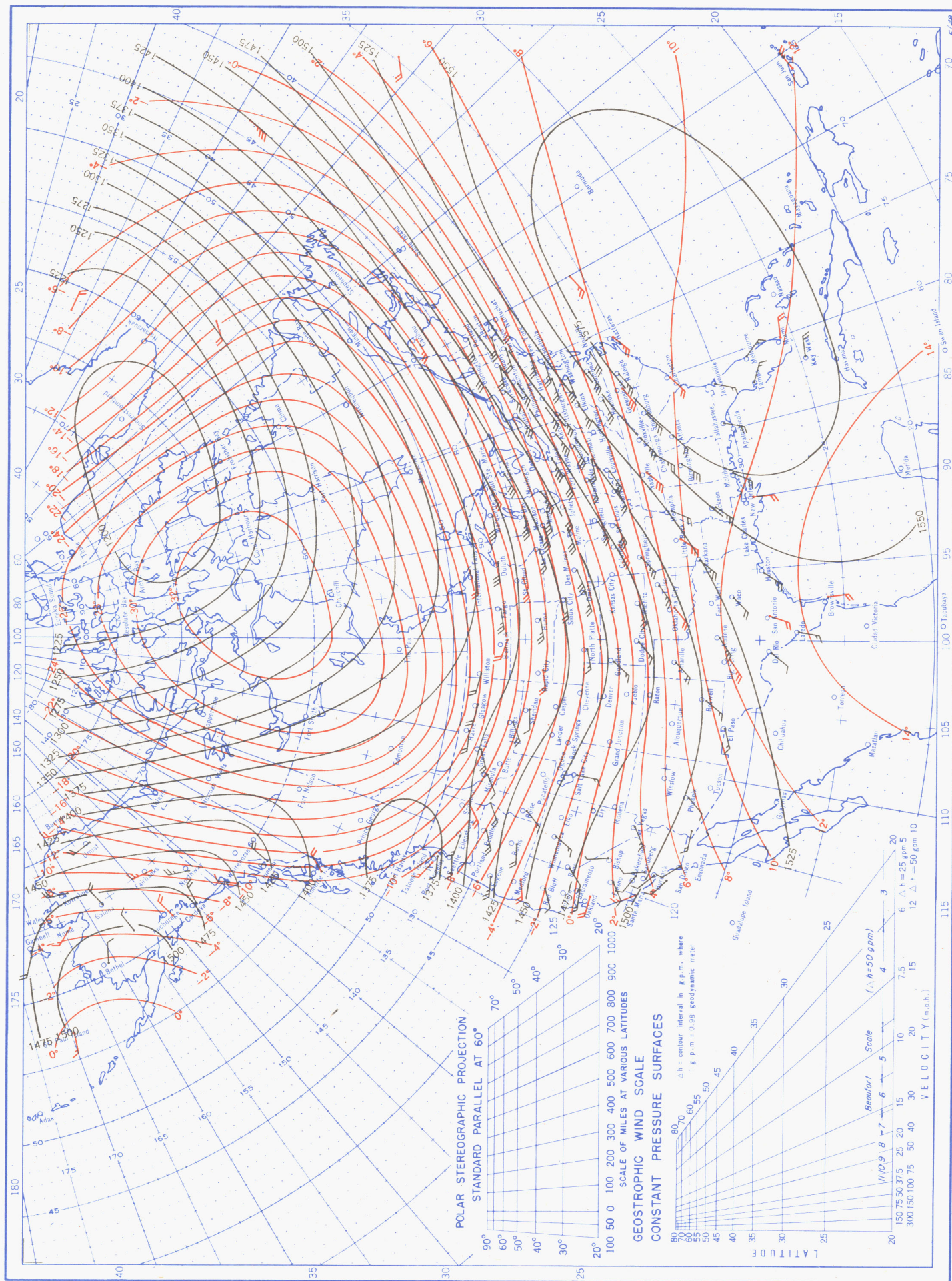
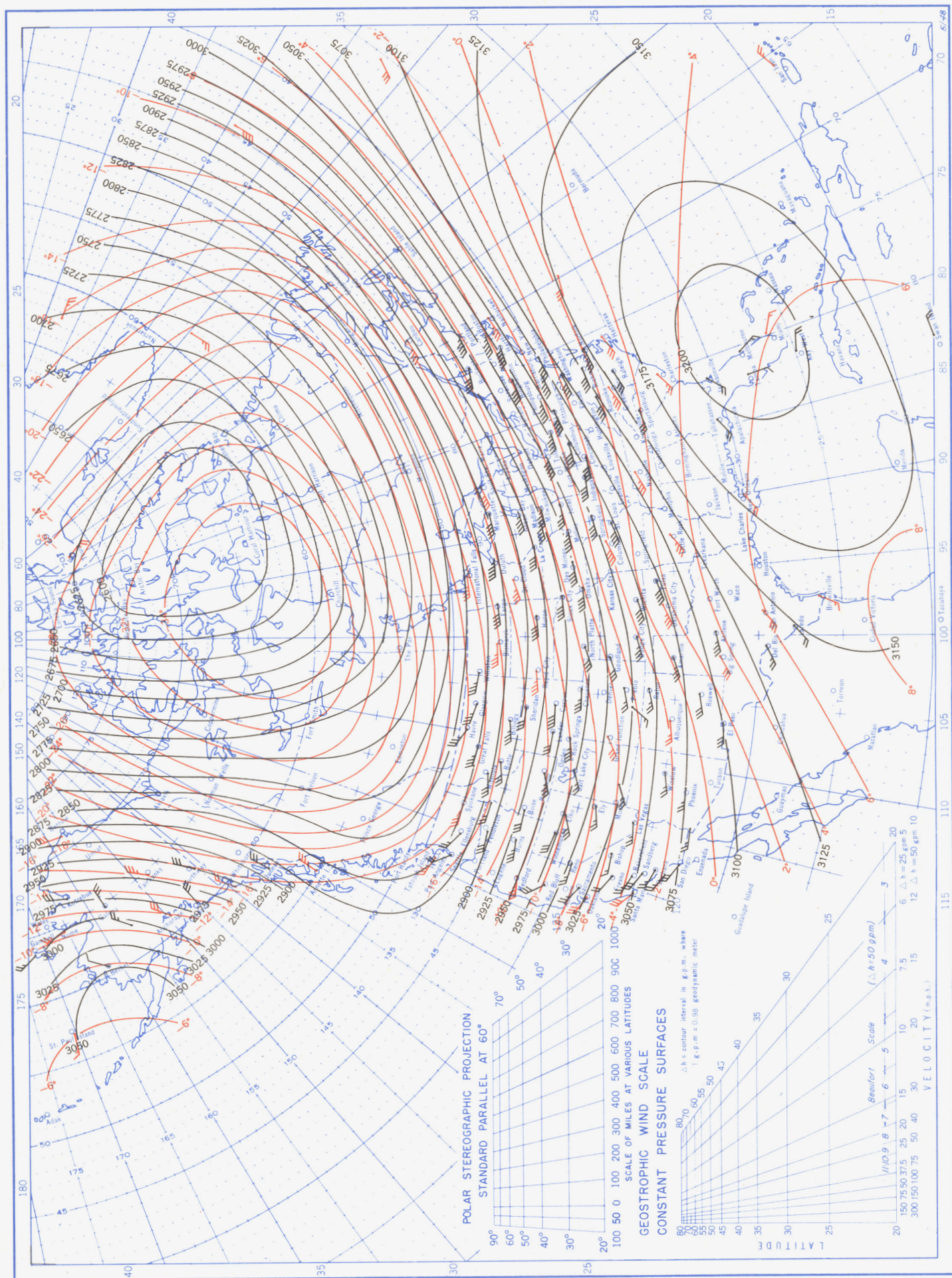




Chart IX, January 1950. Contour Lines of Mean Dynamic Height (Geopotential) in Units of 0.98 Dynamic Meters and Mean Isotherms in Degrees Centigrade for the 700-millibar Pressure Surface, and Resultant Winds at 3,000 Meters (m. s. l.)



Contour lines and isotherms based on radiosonde observations at 0300 G. C. T. Winds indicated by black arrows based on pilot balloon observations at 2100 G. C. T.; those indicated by red arrows based on rawins taken at 0300 G. C. T.



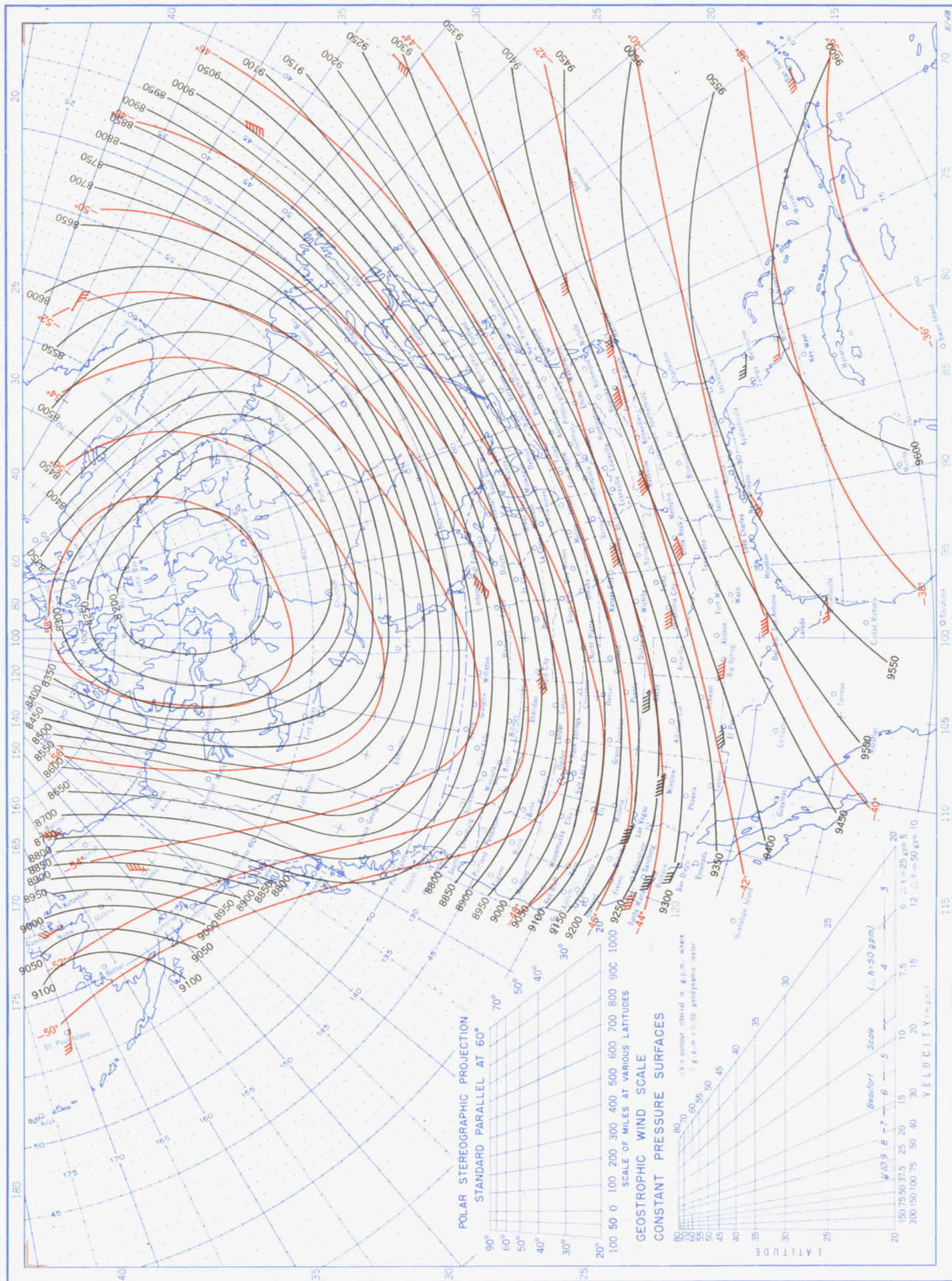
Chart X, January 1950.



Contour lines and isotherms based on radiosonde observations at 0300 G. C. T. Winds indicated by black arrows based on pilot balloon observations at 2100 G. C. T.; those indicated by red arrows based on rawins taken at 0300 G. C. T.



Chart XI, January 1950. Contour Lines of Mean Dynamic Height (Geopotential) in Units of 0.98 Dynamic Meters and Mean Isotherms in Degrees Centigrade for the 300-millibar Pressure Surface, and Resultant Winds at 10,000 Meters (m. s. l.)



Contour lines and isotherms based on radiosonde observations at 0300 G. C. T. Winds indicated by black arrows based on pilot balloon observations at 2100 G. C. T.; those indicated by red arrows based on rawins taken at 0300 G. C. T.